UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/973,786	10/11/2001	Warren B. Jackson	105865	7256

			EXAMINER
27074	7590	09/16/2005	THANGAVELU, KANDASAMY

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ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
Office Action Summary	09/973,786	JACKSON ET AL.
	Examiner	Art Unit	
	Kandasamy Thangavelu	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on <u>27 June 2005</u>.

2a) ☐ This action is **FINAL**.   2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) <u>1-18</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) <u>1-18</u> is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☒ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on <u>11 October 2001</u> is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☐ All   b) ☐ Some * c) ☐ None of:

      1. ☐ Certified copies of the priority documents have been received.

      2. ☐ Certified copies of the priority documents have been received in Application No. _____.

      3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>21 March 2005</u>.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1.   This communication is in response to the Applicants' Response mailed on June 27, 2005. Claims 1, 9, 12, 14 and 17 were amended. Claims 1-18 of the application are pending. This office action is made non-final.

Drawings

2.   The drawings are objected to. In Fig.1, Step S1700,"Is the prediction greater than the noise variance" appears to be incorrect and it appears that it should be "Is the prediction error greater than the noise variance"; in step S1800, "Rank the results of the prediction of each model" appears to be incorrect and it appears that it should be "Rank the results of the prediction of each model based on prediction error".

Corrected drawings are required in response to this office action.

Specification

3.   The disclosure is objected to because of the following informalities:

In Page 9, Paragraph 0033, "In step S1700, a determination is made whether the prediction for any of the models is greater than the noise variance. In step 1700, if the prediction for at least one model is greater than the noise variance, operation continues to step S1800. If not, control returns to step S1200, where each system control model is

reassigned a new weight w_i, and the process continues with steps S1300-S1700"

appears to be incorrect and it appears that it should be "In step S1700, a determination

is made whether the prediction error for any of the models is greater than the noise

variance. In step 1700, if the prediction error for at least one model is greater than the

noise variance, operation continues to step S1800. If not, control returns to step S1200,

where each system control model is reassigned a new weight w_i, and the process

continues with steps S1300-S1700".

In Paragraph 0034, "In step S1800, the results of the prediction of all models are

ranked" appears to be incorrect and it appears that it should be "In step S1800, the

results of the prediction of all models are ranked based on prediction errors".

Appropriate corrections are required.

Claim Rejections - 35 USC § 112

4.   The following is a quotation of the first paragraph of 35 U.S.C. §112:

> The specification shall contain a written description of the invention, and of the manner
> and process of making and using it, in such full, clear, concise, and exact terms as to enable any
> person skilled in the art to which it pertains, or with which it is most nearly connected, to make
> and use the same and shall set forth the best mode contemplated by the inventor of carrying out
> his invention.

5.   Claims 1-18 are rejected under 35 U.S.C. 112, first paragraph, as containing subject

matter which was not described in the specification in such a way as to reasonably convey to one

skilled in the relevant art that the inventor(s), at the time the application was filed, had

possession of the claimed invention.

5.1   Amended claim 1, states in part, "predicting **future behavior of** the multiple

actuator-sensor smart matter **dynamic control system using a plurality of control system**

models; determining at least one control system model which is more successful than at least one

other model of the plurality of models in **predicting the future behavior of** the multiple

actuator-sensor smart matter **dynamic control system**; increasing a weight of the at least one

more-successful control system model in the plurality of **control system models used to predict**

future behavior of the multiple actuator-sensor smart matter **dynamic control system** relative

to a weight of the at least one other model".

Specification Page 8, Para 0029 states "models for use in predicting and controlling

dynamic systems". Para 0030 states, "a number of models are allowed to jointly attempt to

predict and/or control the future behavior of the dynamic system". What is correct? Are the

control models used to predict the **performance of the dynamic system** being controlled or the

behavior of the **dynamic control system** itself? How is the behavior of the **dynamic control**

system specified and what parameters are used to specify the behavior of the dynamic control

system?

It appears that predicting the **future behavior of** the **dynamic control system using a**

plurality of control system models" is incorrect. Typically control system models are used to

generate control signals based on measured state variables of the system and the preset target

values for the parameters of the system being controlled. The control system models do not have

the capability to predict the behavior of the system. Separate **prediction models or process models** are used to which the control signals are input; the prediction models or process models model the dynamics of the system and compute the response of the system for the input control signals and provide the state of the system after some time interval. The state variables are used to compute the performance or behavior of the system.

Claim 1, states in part, "**increasing a weight** of the at least one **more-successful control system model** in the plurality of control system models used to predict future behavior of the multiple actuator-sensor smart matter dynamic control system relative to a weight of the at least one other model". The specification does not describe how a model is identified as more successful than other models. There is no support for **increasing the weight** of at least one **more-successful control system model** in the plurality of control system models used to predict future behavior of the multiple actuator-sensor smart matter dynamic control system relative to a weight of the at least one other model". Specification Pages 9-10, Para 0034 describes how new weights are computed to various models using a formula based on the prediction errors of individual models and the noise variance; it does not state how weight of at least one more-successful control system model in the plurality of control system models is increased relative to a weight of the at least one other model.

It is not clear as to what is done with the weights computed. The specification does not describe anywhere how the weights are used in the dynamic control process or in predicting the future performance or behavior of the system or the dynamic control system.

Claim 1 states in part, "A method for dynamic **control of** a multiple actuator-sensor

smart matter **dynamic control system**" and "using the at least one more-successful control

system model with the increased weight **to control the multiple actuator-sensor smart matter**

dynamic control system". This appears to be incorrect. Specification, Page 7, Para 0028 states

"**a controller to control complex dynamical systems** has an appropriate model of the system

and the effects of various control inputs on the dynamical system". Specification Page 8, Para

0030 states, "a number of models are allowed to jointly attempt to predict and/or control the

future behavior of the dynamic system".

Claim 1 states in part, "using the at least one more-successful control system model with

the increased weight to control the multiple actuator-sensor smart matter dynamic control

system". Does this mean that that there are control system models whose weights will be

decreased? What do you do with those models? Do you simply not use those models any more

for controlling or predicting? Specification Pages 9-10, Para 0034 describes how new weights

are computed to various models using a formula based on the prediction errors of individual

models and the noise variance; it appears that all models are then used for predicting or

controlling using the new weights.

5.2   Claim 9 states in part, "means for predicting a future behavior of a multiple

actuator-sensor smart matter dynamic control system using a plurality of control system models;

means for determining at least one control system model which is more successful than other

models in the plurality of models in predicting future behavior of the multiple actuator-sensor smart matter dynamic control system; means for increasing the weight of the at least one more successful control system model in the plurality of control system models used to predict future behavior of the multiple actuator-sensor smart matter dynamic control system". It appears that it should be "predicting the future performance of the dynamic system", as explained in Paragraph 5.1 above.

It appears that "predicting the **future behavior of** the **dynamic control system using a plurality of control system models**" is incorrect. Typically control system models are used to generate control signals based on measured state variables of the system and the preset target values for the parameters of the system being controlled. The control system models do not have the capability to predict the behavior of the system. Separate **prediction models or process models** are used to which the control signals are input; the prediction models or process models model the dynamics of the system and compute the response of the system for the input control signals and provide the state of the system after some time interval. The state variables are used to compute the performance or behavior of the system.

Claim 9, states in part, "**increasing a weight** of the at least one **more-successful control system model** in the plurality of control system models used to predict future behavior of the multiple actuator-sensor smart matter dynamic control system relative to a weight of the at least one other model". The specification does not describe how a model is identified as more successful than other models. There is no support for "**increasing the weight** of at least one

more-successful control system model in the plurality of control system models used to predict future behavior of the multiple actuator-sensor smart matter dynamic control system relative to a weight of the at least one other model" as explained in Paragraph 5.1 above.

It is not clear as to what is done with the weights computed. The specification does not describe anywhere how the weights are used in the dynamic control process or in predicting the future performance or behavior of the system or the dynamic control system.

Claim 9 states in part, "means for using the at least one more-successful control system model with the increased weight to control the multiple actuator-sensor smart matter dynamic control system". This appears to be incorrect. Specification, Page 7, Para 0028 states "a **controller to control complex dynamical systems** has an appropriate model of the system and the effects of various control inputs on the dynamical system". Specification Page 8, Para 0030 states, "a number of models are allowed to jointly attempt to predict and/or control the future behavior of the dynamic system".

Claim 9 states in part, "means for using the at least one more-successful control system model with the increased weight to control the multiple actuator-sensor smart matter dynamic control system". Does this mean that that there are control system models whose weights will be decreased? What do you do with those models? Do you simply not use those models any more for controlling or predicting? Specification Pages 9-10, Para 0034 describes how new weights are computed to various models using a formula based on the prediction errors of individual

models and the noise variance; it appears that all models are then used for predicting or controlling using the new weights.

5.3   Claim 14 has the limitations based on similar limitations in claim 1 and 9. Therefore, claim 14 is rejected based on the same reasoning as explained in Paragraphs 5.1 and 5.2 above.

5.4   claim 4 states, "each model is used to predict, at a current time t, **a future state of the multiple actuator-sensor smart matter dynamic control system** at a later time (t+Δt):

$$x_i (t + \Delta t; x(t), u(t)),$$

where **x(t) is a state of a multiple actuator-sensor smart matter dynamic control system** at time t, x_i (t + Δt) is a **state of a multiple actuator-sensor smart matter dynamic control system** at time t + Δt estimated by the ith model, and u(t) is a control input at time t". This appears to be incorrect. Specification, Page 9, Para 0032 states, "given the current state of the system x(t), where x is a vector, and the control input u(t), where u is also a vector, each model i attempts to predict the **future state of the system** x_i (t + Δt; x(t), u(t)) at the end of the time interval Δt". Therefore it is the state of the system that is predicted and not the state of the **dynamic control system.**

5.5   Claims 12 and 17 have similar language as in claim 4, referring to the state of the dynamic control system being predicted using the state of the dynamic control system and therefore are rejected based on the same reasoning as described in Paragraph 5.4 above.

Claims rejected but not specifically addressed are rejected based on their dependency on rejected claims.

Claim Rejections - 35 USC § 112

6.   The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7.   Claims 1-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 1, 9 and 14 state in part, "determining at least one control system model which is **more successful** than at least one other model of the plurality of models", "increasing a weight of the at least **one more-successful control system model** in the plurality of control system models" and "using the at least **one more-successful control system model** with the increased weight". The term "more successful" is vague and indefinite. It is not clear as to what the applicants meant by saying "more successful model". The specification does not describe anywhere how the success of the model is specified and measured or computed.

Claims rejected but not specifically addressed are rejected based on their dependency on rejected claims.

8.   Claims 3-5 and 7 are rejected under 35 U.S.C. § 112, second paragraph, as being

incomplete for omitting essential steps, such omission amounting to a gap between the steps.

See MPEP § 2172.01.

8.1   Claim 3 states, "using a plurality of control system models includes defining an investing

fraction a_i of a weight w_i, of an ith model, where $0 < a_i < 1$". It is not clear as to what is done with

defining an investing fraction a_i of a weight w_i. Defining an investing fraction itself is of no use

in predicting or controlling mentioned in claim 1.   It appears that something is done with the

defined investing fraction; a step should be included in this claim which will state as to what is

done with the defined investing fraction.

8.2   Claim 7 states, "The method of claim 1, further including summing prediction error over

a finite interval". It is not clear as to what is done with the summed prediction errors. A step

should be included in this claim which will state as to what is done with the summed prediction

error.

        Claims rejected but not specifically addressed are rejected based on their dependency on

rejected claims.

9.   Claims 11-13, 16 and 18 are rejected under 35 U.S.C. § 112, second paragraph, as being

incomplete for omitting essential structural cooperative elements, such omission amounting to a

gap between the necessary structural connections. See MPEP § 2172.01.

9.1   Claim 11 states, "the means for predicting a further behavior defines an investing fraction

a_i of a weight w_i, of an ith model, where $0 < a_i < 1$". It is not clear as to what is done with

defining an investing fraction a_i of a weight w_i. Defining an investing fraction itself is of no use

in predicting or controlling mentioned in claim 9.   It appears that something is done with the

defined investing fraction; an element should be included which will use the defined investing

fraction.

9.2   Claim 16 states, "the prediction circuit defines an investing fraction a_i of a weight w_i, of

an ith model, where $0 < a_i < 1$". It is not clear as to what is done with defining an investing

fraction a_i of a weight w_i. Defining an investing fraction itself is of no use in predicting or

controlling mentioned in claim 14.   It appears that something is done with the defined investing

fraction; an element should be included which will use the defined investing fraction.

        Claims rejected but not specifically addressed are rejected based on their dependency on

rejected claims.

Claim Interpretations

10.1   In claims 1, 9 and 14:

"predicting future behavior of the multiple actuator-sensor smart matter dynamic control system using a plurality of control system models" has been interpreted as "predicting future behavior of dynamic system using a plurality of prediction models";

"determining at least one control system model which is more successful than at least one other model of the plurality of models in predicting the future behavior of the multiple actuator-sensor smart matter dynamic control system" has been interpreted as "determining at least one prediction model which has less prediction error than at least one other model of the plurality of models in predicting the future behavior of the dynamic system";

"increasing a weight of the at least one more-successful control system model in the plurality of control system models used to predict future behavior of the multiple actuator-sensor smart matter dynamic control system relative to a weight of the at least one other model" has been interpreted as "adjusting the weights prediction models in the plurality of prediction models used to predict future behavior of the dynamic system based on prediction error of the models and noise variance"; and

"using the at least one more-successful control system model with the increased weight to control the multiple actuator-sensor smart matter dynamic control system" has been interpreted as "using the control system models with the adjusted weights to control the dynamic system".

10.2   In claims 4, 12 and 17:

"each model is used to predict, at a current time t, a future state of the multiple actuator-sensor smart matter dynamic control system at a later time $(t+\Delta t)$:

$$x_i (t + \Delta t; x(t), u(t)),$$

where x(t) is a state of a multiple actuator-sensor smart matter dynamic control system at

time t, x_i (t + Δt) is a state of a multiple actuator-sensor smart matter dynamic control system at

time t + Δt estimated by the ith model" has been interpreted as "each model is used to predict, at a

current time t, a future state of the dynamic system at a later time (t+Δt):

$$x_i (t + \Delta t; x(t), u(t)),$$

where x(t) is a state of the dynamic system at time t, x_i (t + Δt) is a state of the dynamic system at

time t + Δt estimated by the ith model".

Claim Rejections - 35 USC § 103

11.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459

(1966), that are applied for establishing a background for determining obviousness under 35

U.S.C. 103(a) are summarized as follows:

1.   Determining the scope and contents of the prior art.
2.   Ascertaining the differences between the prior art and the claims at issue.
3.   Resolving the level of ordinary skill in the pertinent art.
4.   Considering objective evidence present in the application indicating obviousness or nonobviousness.

12.   Claims 1, 6, 8, 9 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Jacques (U.S. Patent Application 2003/0028266) in view of **Raeth et al.** (U.S. Patent

Application 2003/0065409), and further in view of **Phillips et al.** (U.S. Patent 6,473,084) and

Wojsznis et al. (U.S. Patent 6,577,908).

12.1   **Jacques** teaches tuning control parameters of vibration reduction and motion control

systems for fabrication equipment and robotic systems. Specifically as per claim 14, **Jacques**

teaches a dynamic controller of a multiple actuator-sensor smart matter dynamical control system

(Page 1, Para 0001 and Para 0005; Page 2, Para 0010; Page 3, Para 0019 and Para 0020; Page 4,

Para 0032).

Jacques teaches a prediction circuit usable to predict a future behavior of the multiple

actuator-sensor smart matter dynamic control system (Page 3, Para 0019, Para 0020 and Para

0022; Page 2, Para 0010; Page 4, Para 0032). **Jacques** does not expressly teach using a plurality

of control system models to predict a future behavior. **Raeth et al.** teaches using a plurality of

control system models to predict a future behavior (Page 1, Para 0012), because that allows each

prediction model to receive data from one of the sensors and predict the outputs for some future

data sample (Page 1, Para 0012). It would have been obvious to one of ordinary skill in the art at

the time of Applicants' invention to modify the controller of **Jacques** with the controller of

Raeth et al. that included using a plurality of control system models to predict a future behavior.

The artisan would have been motivated because that would allow each prediction model to

receive data from one of the sensors and predict the outputs for some future data sample.

Jacques teaches a success determination circuit usable to determine at least one control

system model (Page 3, Para 0020; Page 3, Para 0022). **Jacques** does not expressly teach a

success determination circuit usable to determine at least one control system model which is

more successful than at least one other model in the plurality of models in predicting the future

behavior of the multiple actuator-sensor smart matter dynamic control system. **Phillips et al.**

teaches a success determination circuit usable to determine at least one control system model

which is more successful than at least one other model in the plurality of models in predicting the

future behavior of the multiple actuator-sensor smart matter dynamic control system (CL5, L10-

28; CL5, L35-47; CL7, L9-23; CL8, L3-5), because that allows ranking based on performance

resulting in more meaningful ranking (Cl7, L15-17) and ranking based on relative accuracies in

individual prediction events (CL8, L3-5). It would have been obvious to one of ordinary skill in

the art at the time of Applicants' invention to modify the controller of **Jacques** with the

controller of **Phillips et al.** that included a success determination circuit usable to determine at

least one control system model which is more successful than at least one other model in the

plurality of models in predicting the future behavior of the multiple actuator-sensor smart matter

dynamic control system. The artisan would have been motivated because that would allow

ranking based on performance resulting in more meaningful ranking and ranking based on

relative accuracies in individual prediction events.

Jacques does not expressly teach a weight increasing circuit usable to increase the

weight of the at least one more successful control system model relative to the at least one other

model. **Phillips et al.** teaches a weight increasing circuit usable to increase the weight of the at

least one more successful control system model relative to the at least one other model (CL5,

L41-42; CL11, L46-52), because that allows more accurate predictions by using a weighted

average of forecasts (CL6, L6-8; CL11, L46-52). It would have been obvious to one of ordinary

skill in the art at the time of Applicants' invention to modify the controller of **Jacques** with the

controller of **Phillips et al.** that included a weight increasing circuit usable to increase the weight

of the at least one more successful control system model relative to the at least one other model.

The artisan would have been motivated because that would allow more accurate predictions by

using a weighted average of forecasts.

Jacques teaches a dynamic controller of a multiple actuator-sensor smart matter

dynamical control system (Page 1, Para 0001 and Para 0005; Page 2, Para 0010; Page 3, Para

0019 and Para 0020; Page 4, Para 0032). **Jacques** does not expressly teach a controller that uses

the at least the one more-successful control system models to control the multiple actuator-sensor

smart matter dynamic control system. **Wojsznis et al.** teaches a controller that uses the at least

the one more-successful control system models to control the multiple actuator-sensor smart

matter dynamic control system (Abstract L1-14; CL2, L13-18; CL3, L52-57; CL4, L48 to CL5,

L2), because that allows attainment of adaptation with reduction in process excitation, shorter

adaptation time, and simplicity in design (CL3, L31-34). It would have been obvious to one of

ordinary skill in the art at the time of Applicants' invention to modify the controller of **Jacques**

with the controller of **Wojsznis et al.** that included a controller that uses the at least the one

more-successful control system models to control the multiple actuator-sensor smart matter

dynamic control system. The artisan would have been motivated because that would allow

attainment of adaptation with reduction in process excitation, shorter adaptation time, and

simplicity in design.

12.2   As per Claims 1 and 9, these are rejected based on the same reasoning as Claim 14, supra.

Claims 1 and 9 are a method claim and a dynamic controller with a means for claim reciting the

same limitations as Claim 14, as taught throughout by **Jacques, Raeth et al., Phillips et al.** and

Wojsznis et al.

12.3   As per claims 6 and 8, **Jacques, Raeth et al., Phillips et al.** and **Wojsznis et al.** teach the

method of claim 1. **Jacques** teaches repeating the predicting, determining and increasing steps

within one or more selectable time periods (Fig. 1, Fig. 3 and Fig. 4); and the method of claim 1,

comprising adding new models (Page 3, Para 0019 and Para 0020).

13.   Claims 2, 10 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Jacques (U.S. Patent Application 2003/0028266) in view of **Raeth et al.** (U.S. Patent

Application 2003/0065409), **Phillips et al.** (U.S. Patent 6,473,084) and **Wojsznis et al.** (U.S.

Patent 6,577,908), and further in view of **Spoerre et al.** (U.S. Patent 5,602,761).

13.1   As per claim 15, **Jacques, Raeth et al., Phillips et al.** and **Wojsznis et al.** teach the

controller of claim 14. **Jacques** does not expressly teach that the plurality of control system

models comprises N control system models. **Raeth et al.** teaches that the plurality of control

system models comprises N control system models (Page 1, Para 0012), because that allows each

prediction model to receive data from one of the sensors and predict the outputs for some future

data sample (Page 1, Para 0012). It would have been obvious to one of ordinary skill in the art at

the time of Applicants' invention to modify the controller of **Jacques** with the controller of

Raeth et al. that included the plurality of control system models comprising N control system

models. The artisan would have been motivated because that would allow each prediction model

to receive data from one of the sensors and predict the outputs for some future data sample.

Jacques does not expressly teach that each of the N control system models is initially

assigned a weight w_i. **Phillips et al.** teaches that each of the N control system models is initially

assigned a weight w_i (CL5, L41-42; CL11, L46-52), because that allows more accurate

predictions by using a weighted average of forecasts (CL6, L6-8; CL11, L46-52). It would have

been obvious to one of ordinary skill in the art at the time of Applicants' invention to modify the

controller of **Jacques** with the controller of **Phillips et al.** that included each of the N control

system models being initially assigned a weight w_i. The artisan would have been motivated

because that would allow more accurate predictions by using a weighted average of forecasts.

Jacques does not expressly teach that initially assigned weight w_i are selected such that

$\Sigma_{i=1}^{N} w_i = 1$. **Spoerre et al.** teaches that initially assigned weight w_i are selected such that $\Sigma_{i=1}^{N} w_i$

$= 1$ (CL9, L17-52; CL9, L40-43), because as per **Phillips et al.** that allows obtaining more

accurate predictions using a weighted average of forecasts (CL6, L6-8; CL11, L46-52). It would

have been obvious to one of ordinary skill in the art at the time of Applicants' invention to

modify the controller of **Jacques** with the controller of **Spoerre et al.** that included initially

assigned weight w_i being selected such that $\Sigma_{i=1}^{N} w_i = 1$. The artisan would have been motivated

because that would allow obtaining more accurate predictions using a weighted average of

forecasts.

13.2   As per Claims 2 and 10, these are rejected based on the same reasoning as Claim 15,

supra. Claims 2 and 10 are a method claim and a dynamic controller means for claim reciting

the same limitations as Claim 15, as taught throughout by **Jacques, Raeth et al., Phillips et al.,**

Wojsznis et al. and **Spoerre et al.**

14.   Claims 4, 12 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Jacques (U.S. Patent Application 2003/0028266) in view of **Raeth et al.** (U.S. Patent

Application 2003/0065409), **Phillips et al.** (U.S. Patent 6,473,084) and **Wojsznis et al.** (U.S.

Patent 6,577,908), and further in view of **Muravez** (U.S. Patent Application 2004/0155142).

14.1   As per claim 17, **Jacques, Raeth et al., Phillips et al.** and **Wojsznis et al.** teach the

controller of claim 14. **Jacques** does not expressly teach that each model is used to predict, at a

current time t, a future state of the multiple actuator-sensor smart matter dynamic control system

at a later time (t+Δt): x_i (t + Δt; x(t), u(t)), where x(t) is a state of a multiple actuator-sensor

smart matter dynamic control system at time t, x_i (t + Δt) is a state of a multiple actuator-sensor

smart matter dynamic control system at time t + Δt estimated by the ith model, and u(t) is a

control input at time t. **Muravez** teaches that each model is used to predict, at a current time t, a

future state of the multiple actuator-sensor smart matter dynamic control system at a later time

(t+Δt): x_i (t + Δt; x(t), u(t)), where x(t) is a state of a multiple actuator-sensor smart matter

dynamic control system at time t, x_i (t + Δt) is a state of a multiple actuator-sensor smart matter

dynamic control system at time t + Δt estimated by the ith model, and u(t) is a control input at

time t (Page 9, Para 0091), because that allows using the predicted future states to calculate

residual errors and variances and compute the weights of the models (Page 9, Para 0088 and

0089). It would have been obvious to one of ordinary skill in the art at the time of Applicants'

invention to modify the controller of **Jacques** with the controller of **Muravez** that included each

model being used to predict, at a current time t, a future state of the multiple actuator-sensor

smart matter dynamic control system at a later time (t+Δt): x_i (t + Δt; x(t), u(t)), where x(t) was a

state of a multiple actuator-sensor smart matter dynamic control system at time t, x_i (t + Δt) was

a state of a multiple actuator-sensor smart matter dynamic control system at time t + Δt estimated

by the ith model, and u(t) was a control input at time t. The artisan would have been motivated

because that would allow using the predicted future states to calculate residual errors and

variances and compute the weights of the models.

14.2   As per Claims 4 and 12, these are rejected based on the same reasoning as Claim 17,

supra. Claims 4 and 12 are a method claim and a dynamic controller means for claim reciting

the same limitations as Claim 17, as taught throughout by **Jacques, Raeth et al., Phillips et al.,**

Wojsznis et al. and **Muravez.**

Response to Arguments

15.   Applicant's arguments filed on June 27, 2005 have been fully considered. The arguments

with respect to 103 (a) rejections are persuasive. In addition claim rejections under 35 USC 112

First paragraph and Second Paragraph are included in this office action.

15.1   As per the applicants' argument that "Jacques discloses using a model to estimate the

behavior of an apparatus, and using the estimated result to control the behavior of the apparatus;

the purpose for estimating the behavior of the apparatus is to use the estimated result to control

the behavior of the apparatus; Phillips is directed to prediction used in forecasting contests;

Phillips discloses giving more weight to clustered predictions that have historically better

prediction accuracies; however, the weights are merely used in forecasting; the weights are not

provided for controlling the outcome of the event; Phillips is not directed to controlling the

behavior of an apparatus; one of ordinary skill in the art would not have been motivated to

combine Phillips with Jacques because in the Jacques system, which controls behavior, there is

simply no need for or benefit to be gained from, predicting behavior as per Phillips", the

examiner has used a new reference **Wojsznis et al.**

Wojsznis et al. teaches a controller that uses the at least the one more-successful control

system models to control the multiple actuator-sensor smart matter dynamic control system;

Wojsznis et al. teaches a controller with a set of models that uses a weighted sum of the models;

each model in the set generates a prediction of the process output and the corresponding weight

is adjusted automatically as a function of prediction error (Abstract L1-14; CL2, L13-18; CL3,

L52-57; CL4, L48 to CL5, L2).

15.2   As per the applicants' argument that "Jacques, Raeth and Phillips, even if combined, do

not disclose or suggest predicting future behavior of a multiple actuator-sensor smart matter

dynamic control system using a plurality of control system models, and using at least one more

successful control system model with an increased weight to control the multiple actuator-sensor

smart matter dynamic control system, as recited in claim 1, and similarly recited in claims 9 and

14", the examiner respectfully disagrees.

Raeth et al. teaches using a plurality of control system models to predict a future

behavior (Page 1, Para 0012), because that allows each prediction model to receive data from

one of the sensors and predict the outputs for some future data sample (Page 1, Para 0012).

Phillips et al. teaches a weight increasing circuit usable to increase the weight of the at

least one more successful control system model relative to the at least one other model (CL5,

L41-42; CL11, L46-52), because that allows more accurate predictions by using a weighted

average of forecasts (CL6, L6-8; CL11, L46-52).

Wojsznis et al. teaches a controller that uses the at least the one more-successful control

system models to control the multiple actuator-sensor smart matter dynamic control system; and

a controller with a set of models that uses a weighted sum of the models; each model in the set

generates a prediction of the process output and the corresponding weight is adjusted

automatically as a function of prediction error (Abstract L1-14; CL2, L13-18; CL3, L52-57;

CL4, L48 to CL5, L2), because that allows attainment of adaptation with reduction in process

excitation, shorter adaptation time, and simplicity in design (CL3, L31-34).

15.3   As per the applicants' argument that "Phillips does not disclose or suggest giving more

weight to more-accurate clustered predictions for controlling the behavior or the event; the

alleged combination of Jacques and Phillips, at most, would only disclose using increased weight

of a model in predicting he behavior of an apparatus; such an alleged combination would not

disclose or suggest increasing weight to a model in controlling the behavior of the apparatus;

therefore, even if combined, Jacques and Phillips would not have resulted in predicting future

behavior of a multiple actuator-sensor smart matter dynamic control system using a plurality of

control system models, and using at least one more-successful control system model with the

increased weight to control the multiple actuator sensor smart matter dynamic control system, as

recited in claim 1, and similarly recited in claims 9 and 14", the examiner has used **Phillips et al.**

with **Wojsznis et al.** which teach these limitations as described in Paragraph 15.2 above.

15.4   As per the applicants' argument that "Spoerre does not disclose or suggest predicting

future behavior of a multiple actuator sensor smart matter dynamic control system using a

plurality of control system models, and using at least one more successful control system model

with increased weight to control the multiple actuator-sensor smart matter dynamic control

system, as recited in claim 1, and similarly recited in claims 9 and 14", the examiner has used

Phillips et al. with **Wojsznis et al.** which teach these limitations as described in Paragraph 15.2

above.

Conclusion

16.   Any inquiry concerning this communication or earlier communications from the

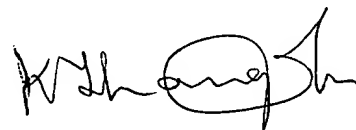examiner should be directed to Dr. Kandasamy Thangavelu whose telephone number is

571-272-3717. The examiner can normally be reached on Monday through Friday from

8:00 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Leo Picard, can be reached on 571-272-3749. The fax phone number for

the organization where this application or proceeding is assigned is 571-273-8300.

Any inquiry of a general nature or relating to the status of this application or

proceeding should be directed to TC 2100 Group receptionist: 571-272-2100.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free).

K. Thangavelu
Art Unit 2123
September 14, 2005